E/E ARCHITECTURE TREND

- CENTRAL UNIT PERFORMANCE GROWTH WITH CENTRALIZATION
- EVOLVED THROUGH DOMAIN ARCHITECTURE TO ZONE ARCHITECTURE
- MANY PARTIAL INTEGRATIONS IN THE MARKET

MIGRATION
2025CY to 2030CY

Domain Architecture

PAST
Central Architecture

FUTURE
Beyond 2030CY
Zonal Architecture
28NM WORLD-LEADING FLASH TECHNOLOGY

Changing Industry Needs Driving Automotive MCUs
- Multi-Core (High Performance & Robustness)
- Low Power Consumption (Overheating Prevention)
- Increasing Program Capacity
- High Integration (Cutting-Edge Features)

Development & Production Partnership of Next-Gen World Standard 28nm MCU *1

Green-Car Autonomous Driving Zone ECU

*1: Announced on September 1, 2016
PRODUCT POSITIONING
RENESAS AUTOMOTIVE 32-BIT MCUS LINE UP

Vehicle motion
- ICE
- xEV

- Accelerator for model-based design & Artificial Intelligence
- RDC interface for high carrier, Multiphase control

DCU / Zone / Gateway
- Powertrain
- Body

- QoS, Hardware Accelerator
- High performance CPU
- Hypervisor, Low power consumption

Energy Management & Body

- Low Standby Power

Chassis & Safety

- Small package, Multi Core

Instrument Cluster

- HMI support with powerful 2.5D GPU

RH850/E Series

RH850/C Series

RH850/F Series

RH850/P Series

RH850/D Series

RH850/U2B

NEW

CPU: up to 8x 400MHz
ROM: up to 32MB

RH850/U2A

NEW

CPU: up to 4x 400MHz
ROM: up to 16MB

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RH850/U2A OVERVIEW
U2A SERIES – HIGHLIGHTS & KEY FEATURES

Performance → Highest at Low Power Consumption

- Multi-core: Up to 4+4 CPUs @400MHz → highest performance with Lockstep
- RH850 G4MH2 core: Out of order execution
- Low latency Flash & RAM access

Scalability & Flexibility

- Up to BGA516 packages
- Line-up with up to 16MB code flash, multi core up to (4+4) (main + lockstep)
- IP consolidation → SW re-usability

Technologies

- Over-The-Air update → No-wait OTA in field
- CPU virtualization → ECU integration with Freedom-from-Interference using Hypervisor
- Network + Connectivity → Gbit Ethernet
- FMONOS → 28nm extremely fast flash technology, reliable, proven, scalable

Safety & Security → ASIL D and Evita-Full

- Support ASIL D application
- HSM for EVITA-Full

System Development Environment → Model-based

- Processor model: Simulation/Virtual Prototyping
### System
- DMA +DTS
- Interrupt Controller
- Main OSC
- Internal OSC
- PLL
- Standby-Modes
- Low Power Sampler
- Clock Monitor
- Voltage Monitor
- Temperature Sensor
- Error Control Module
- ICUMH for Security
  - Evita Full
- MBIST/LBIST
- Nexus-JTAG
- Boundary Scan

### 32-bit CPU
- Up to 4 RH850 G4MH Core + 4 Lock Step Core
  - @ 400 MHz
  - Tj = -40 ~ up to +160 °C*
- Hypervisor
- MPU, FPU

### Memory
- Up to 16 MB Code Flash
- Up to 512 KB Data Flash
- Up to 3.6MB RAM
- eMMC
- SFMA

### Interfaces
- 1Gbit Ethernet
- 100MBit Ethernet
- RSCAN-FD
- FlexRay
- FlexRay
- MSPI
- RLIN3
- RHTS
- RHIIF
- WDT
- PSI5
- PSI5-S
- SCI3
- PIC1/2

### Abbreviations:
- ADC: Analog to Digital Converter
- CXPI: Clock Extension Peripheral Interface
- MBIST: Memory Build-In Self-Test
- FPU: Floating Point Unit
- GTM: Generic Timer Module
- ICUM: Intelligent Cryptographic Unit Master
- LBIST: Logic Build-In Self-Test
- LTSC: Long-Term System Counter
- MPU: Memory Protection Unit
- MSPI: Multi-channel Serial Peripheral Interface
- OSTM: OS Timer
- PSI5: Peripheral Sensor Interface 5
- PSI5S: Peripheral Sensor Interface 5 Serial Communication Mode
- RSENT: Renesas Single Edge Nibble Transmission
- RTC: Real-Time Timer
- T/H: Track & Hold
- TPTA: Timer Pattern Buffer
- WDT: Window Watchdog Timer

*depends on the package

### Generic Timers
- GTM v3.5
- TAUD
- TAUJ
- TPTM
- LTSC
- OSTM
- WDT
- TAPA
- TSG3
- ENCA
- TPBA
- RTC
- PWM Diagnostic

### Analog
- SAR-ADC, T/H
APPLICATION EXAMPLES
THE VALUE THAT U2A OFFERS
BENEFITS FOR A DCU/ZONE ECU

- **Highest Performance**
  - 4 x RH850 G4MH cores with 400MHz deliver more than 6kDMIPS

- **Excellent connectivity**
  - Supports multiple Interfaces (Ethernet, FlexRay, CAN etc.)
  - Fast connectivity to the Central ECU (Gbit Ethernet)

- **Ideal for DCU/Zone with Integration of Applications**
  - Build-in Hypervisor for separation of applications
BENEFITS FOR A BCM/SMALL ZONE ECU

Highest Performance & Integration Support

- Up to 4 x RH850 G4MH cores with 400MHz deliver more than 6kDMIPS
- HW Hypervisor support

Excellent connectivity & Large Packages

- Supports multiple Interfaces (Ethernet, FlexRay, CAN etc.
- Fast connectivity to the Central ECU (Gbit Ethernet)
- Many ADC channels

Low Power Modes

- Deep stop mode
BENEFITS FOR AN EPS CONTROLLER

- Optimized Peripheral Set for BLDC Control
  - Dedicated timers (TSG3, GTM)
  - ADC w/ T/H
  - High speed serial interfaces (CAN-FD, Flexray, Ethernet) for accurate control

- Small packages for fail operational / dual devices
  - Small BGA package for minimum footprint

- Ideal for Actuators which need high performance for high quality control
  - 400MHz CPU frequency
  - ASIL-D compliant
HIGH PERFORMANCE FOR INTEGRATED SYSTEMS

- Dedicated timers (TSG3, GTM) for BLDC control
- High speed serial interfaces (CAN-FD, Flexray, Ethernet) for low latency network connections
- Many sensor interfaces (SENT, PSI5, etc.)

WIDE PERIPHERAL SET

- Full trace using the high bandwidth Aurora interface
- Emulation RAM for calibration
- Memory Access Unit for bypass

BENEFITS FOR A BRAKE CONTROLLER

- 400MHz CPU frequency
- Multi-Core,
- ASIL-D compliant
FUNCTIONAL SAFETY SUPPORT PROGRAM FOR AUTOMOTIVE
FUNCTIONAL SAFETY
SUPPORT PROGRAM FOR AUTOMOTIVE

Hardware
Safety mechanisms
MCU, SoC, A&P

Software
CPU Core self-test
Safety Software

Work Products
Safety analysis tool,
Report, etc.

Consulting
Workshop
Development support
RH850 TOOLS ECO SYSTEM OVERVIEW

IDEs/Compiler

Emulator

Evaluation Boards

Timing/Scheduling Analysis

Programmer

Emulation Manual

Auto Code Generation

Samples

Getting Started

Software Manual

Processor model

Application Notes

User’s Manual

Evaluation Boards

Measurement & calibration

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Application Notes

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